

ROCKY MOUNTAIN FOREST & RANGE EXPERIMENT STATION  
Fort Collins, Colorado      Raymond Price, Director

Biological Evaluation of Spruce Budworm  
Region 3

Donald A. Pierce, Entomologist  
FOREST SERVICE - U.S. DEPARTMENT OF AGRICULTURE

-1959-

# BIOLOGICAL EVALUATION OF SPRUCE BUDWORM

## Region 3

## Work Plan

### INTRODUCTION

The first record of the spruce budworm Choristoneura fumiferana (Clem.) in Region 3 was on the Carson National Forest in 1922. It is one of the important forest pests of the Southwest.

Two large and several small aerial spraying programs have been conducted against the budworm in Region 3 since 1950. The decision for control was based upon the amount of current defoliation of the trees. This was not an accurate criterion since population trend sometimes is not related to the amount of current damage.

Realizing the need to know more of the biological aspects of these infestations, a meeting on spruce budworm appraisals was held at the Boise Research Center, Boise, Idaho, in April 1959. Val Carolin of the Pacific Northwest Experiment Station presented the results of his research on techniques for sampling budworm populations. The discussions centered on how to incorporate these findings in biological evaluations. This plan is based on the results of that meeting.

The biological evaluation will be in three parts: an egg mass survey conducted in the summer after most of the eggs have hatched

to determine the trend of the population by obtaining the ratio of new to old egg masses; a larval count in the spring to obtain population levels and to relate this to the egg mass counts; and a damage estimate made in conjunction with the egg mass survey, to obtain the percent of current defoliation and relate it to the larval population.

The need to biologically evaluate an infestation will be determined from a detection survey. Before an evaluation is practical, there must be a sizeable insect population present.

#### Egg Mass Sampling

The number of plots needed to adequately sample the infestations should be determined and located on a map. The plots are temporary, and consist of 5 trees of a single species. The trees should be dominant and co-dominant, 55-70 feet tall and 15-20 inches d.b.h.

Before sampling is started a temporary headquarters should be established close to the infestation where the samples can be brought for examination. Arrangements for temporary help to examine the foliage should be made. It has been found that women are best suited for this type of work.

Sampling should be confined to Douglas-fir when possible. Feeding by budworm larvae does not damage Douglas-fir as much as it does white

fir. The adult moths will lay eggs on Douglas-fir where they would not on a white fir that had suffered heavy branch and tip killing. A sample from white fir in a mixed stand of white and Douglas-fir may not give an accurate picture of the existing population.

The sample unit will be one whole branch. (The 15-inch twig is an unreliable sample because as defoliation increases, less foliage is available for eggs to be laid on.) The whole branch sample is derived by taking two branches from opposite sides of the tree at midcrown and clipping the foliage from one side of each branch. The foliage should be taken off the right side of one branch and the left side of the other.

Samples are taken at midcrown since it has been found that the variation between the means at this location is less than between the means of samples taken at the base. Shading of the lower branches, resulting in less foliage, accounts for the greater variation.

The collection of branch samples should begin when 90 percent of the egg masses have hatched. Unhatched egg masses are the color of the foliage and extremely hard to locate whereas hatched egg masses are whitish and somewhat easier to see.

A 24' aluminum extension ladder and a pruning saw will be used to collect the samples. When a branch is cut it should be thrown out from the tree in such a manner that it lands on the butt end on



a cloth that has been previously spread on the ground. Landing on the butt allows the branch to ease to the ground, helping to keep the egg masses from jarring from the new foliage. (The egg masses do not adhere too well to new foliage.)

The branch is trimmed of half its foliage, the butt is blazed and the tree and plot number are marked on with indelible pencil. The branch samples are then transported to the examining station. A wet cloth should be placed over the foliage to keep it fresh and to keep it cool enough to allow hatching to progress.

At the examining station the number of square inches of foliage is obtained for each sample. Assuming the foliated part of the branch to be a triangle, measure the base and height, and apply the formula,  $\text{area} = \frac{1}{2} b.h.$

The foliage checkers work at picnic tables set up out-of-doors where the light is good, but not in direct sunlight. They are supervised by one permanent man. The checkers are instructed to collect anything they find on the foliage and keep it separate by branch and plot. The supervisor examines the collected material, discards any extraneous material and roughly separates old and new egg masses. The needles containing the egg masses are put in # 000 gelatin capsules, along with a label containing the branch and plot number. The capsules are put in small boxes which are labeled with the plot number.

In the laboratory the ratio of new to old egg masses per 1,000 square inches of foliage is obtained. This can be used as an indication of trend. The percent of hatch of the new eggs should be noted. If it is less than 80 or 90 percent, which is normal, a careful count is necessary.

### Larval Population Sampling

Sampling the larval population is done in the spring when the larvae are attacking the buds. Plots for larval sampling can have the same locations as those used for egg mass sampling. The plots consist of 25 trees of the same species--Douglas-fir where possible. The trees are marked to be used again in estimating damage.

The sampling unit in this case is a 15-inch twig. Four 15-inch twigs will be taken from the lower crown of each tree. A pole pruner equipped with a basket to catch the twigs, is used to collect the samples.

The number of larvae and the number of buds on each 15-inch twig are counted. The number of buds per twig is needed for later use in relating the defoliation to population.

The number of egg masses per 1,000 square inches of foliage can be related to the number of larvae per 100 15-inch twigs.

### Estimating Damage

Defoliation estimates are made on the same plots and trees after the insects have pupated. Ocular estimates in percent of defoliation are made of each tree crown, by two men using field glasses. When this has been done for all 25 trees, cut a few branches from the various crown levels to see if the estimate was high or low.

It should be possible to relate the estimate of defoliation to the estimate of larval population.

### Collection of Parasites

Larvae of the spruce budworm will be collected and reared in Melrose boxes to obtain parasites. If only one collection can be made for parasites, collect when the budworm is in the last instar and about 40% have pupated. There are more parasites at that time and they have the most influence on the budworm population.

### Discussion

After several spruce budworm infestations have been evaluated as described above, enough information will be available to evaluate an infestation from an egg mass survey alone. It will be possible to estimate quite accurately the expected larval population and the damage it will cause the following year.



### Plan for 1959

Eighteen plots will be established for egg mass sampling. Six plots will be located near Taos, New Mexico, six plots near Chama, New Mexico, three plots in the vicinity of Jemez Springs, New Mexico, and three plots north of Cuba, New Mexico.

Temporary headquarters will be established at Taos during the sampling. Three women will be hired for a period of three weeks to examine the foliage.

Costs of sampling budworm egg masses in 1959, apart from salaries of permanent personnel, will be as follows:

3 women, GS-2 for 15 days	\$ 578.00
Travel in pickup, 2,000 mi. @ 8¢ mi.	160.00
Travel in Jeep Sta. Wag., 1,500 mi. @ 12¢ mi.	180.00
24 ft. aluminum extension ladder	49.00
Rack on pickup to carry ladder	75.00
	<u>\$1,042.00</u>